

MULTI-FUNCTION COUNTER

MF1000

OPERATING MANUAL



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SECTION 1

INTRODUCTION & SPECIFICATION

1. INTRODUCTION

This instrument is a 10Hz to 1000MHz multiple-function counter.

It features a eight digit, high bright seven segment LED display, four function performance, low power consumption circuit design, small size, light weight, high-stabilized crystal oven oscillator for measurement of accuracy and full input signal conditioning.

The four functions are frequency, period, totalize and self check.

This is accomplished by a single LSI intergrated circuit. The input signal can be conditioned by attenuation.

The location of controls, indicators, connectors and all of information for this model are provided in this manual. It is recommended that whole information and details should be read and understood before attempting to operate the instrument for correct operation and best results.

2. SPECIFICATIONS

The pertinent specifications are listed as follows:

A. Measuring Mode

Frequency measurements

CHANNEL A.

| | | |
|------------|---|--|
| Range | : | 10Hz to 10MHz direct counter 10MHz to 100MHz prescaled by 10 |
| Resolution | : | Direct counter : 1, 10, 100Hz switch selectable. Prescaled : 10, 100, 1000Hz switch selectable. |
| Gate time | : | 0.01S, 0.1S, 1S Switch selectable: |
| Accuracy | : | ± 1 count \pm time base error x frequency. |

CHANNEL B.

| | | |
|------------|---|--|
| Range | : | 100MHz to 1GHz |
| Resolution | : | 100Hz, 1KHz, 10KHz switch selectable. |
| Gate time | : | 0.027S, 0.27S, 2.7S Switch selectable. |
| Accuracy | : | ± 1 count \pm time base error x frequency. |

Period measurements (Channel A)

| | | |
|------------|---|--|
| Range | : | 10Hz to 2.5MHz |
| Resolution | : | 10^{-7} S, 10^{-8} S, 10^{-9} S switch selectable. |
| Accuracy | : | ± 1 count \pm time base error x period |

Totalize measurements (Channel A)

| | | |
|------------|---|-------------------------|
| Range | : | 10Hz to 10MHz |
| Resolution | : | ± 1 count of input. |

B. Input Characteristics

CHANNEL A.

Input sensitivity: 10MHz Range : 10Hz ~ 8MHz 25mVrms
8MHz ~ 10MHz 50mVrms
100MHz Range : 10MHz ~ 80MHz 25mVrms
80MHz ~ 100MHz 50mVrms

Attenuation : x1, x20 fixed
Filter (CHA ONLY) : Low pass ~ 100KHz, -3dB
~ 150KHz, -3dB at 20dB ATT

Impedance : approx. 1 M ohm less then 35pF
Maximum voltage without damage : 250 V (DC + AC rms)

CHANNEL B.

Input sensitivity: 20mVrms
Impedance : approx. 50 ohm
Maximum voltage without damage : 3V

C. Time Base

Frequency : 10 MHz, 3.90625 MHz (oven)
Short Term Stability : $\pm 3 \times 10^{-9}$ for 1S average.
Long Term Stability : $\pm 2 \times 10^{-5}$ /month
Temperature : $\pm 1 \times 10^{-5}$, 0°C to 40°C
Line Voltage : $\pm 1 \times 10^{-7}$ for 10% change

D. General

Display : 8 digits, 7mm red LED display with decimal point, gate, overflow, KHz, MHz and μ S indication.
Check : Counts internal 10 MHz time base oscillator.
Power requirement: Line : 115/230 V \pm 15%
45 Hz ~ 70 Hz

Warm-up time : 20 minutes when cold started at 25°C
Temperature : Rated range of use : -5°C ~ +50°C
Storage and transport : -40°C ~ +60°C

Humidity : Operating : 10 ~ 90% RH
storage : 5 ~ 95% RH

Dimension and Weight: Width : 205 mm
Height : 76mm
Depth : 267mm
Weight : 2,150g

E. Supplied Accessories : Power cord
Operating Manual

F. Optional Accessories : BNC to BNC Lead, 50 ohm, 100cm
BNC to Alligator clip Lead, 50ohm, 100cm

SECTION 2 OPERATION

1. INTRODUCTION

This section provides complete operating information needed for this multi-function counter. This section includes a description of all front panel controls, connectors and indicators, operating instructions, operator's maintenance.

2. PREPARATION FOR USE

1) Power Requirements.

It requires a power source of 115 or 230V AC, 45 to 70Hz single phase. Power consumption is 10 watts maximum.

2) Line Voltage Selection.

Line voltage selection is determined by the position of the line voltage selector switch located on the rear panel. Line voltage is preset at the factory for 115V (90~120V) or 230V (180~250V) as ordered by the customer.

3) Wait about 20 minutes for correct measurement until the crystal oven oscillator gets stable in aging.

3. FRONT PANEL FEATURES

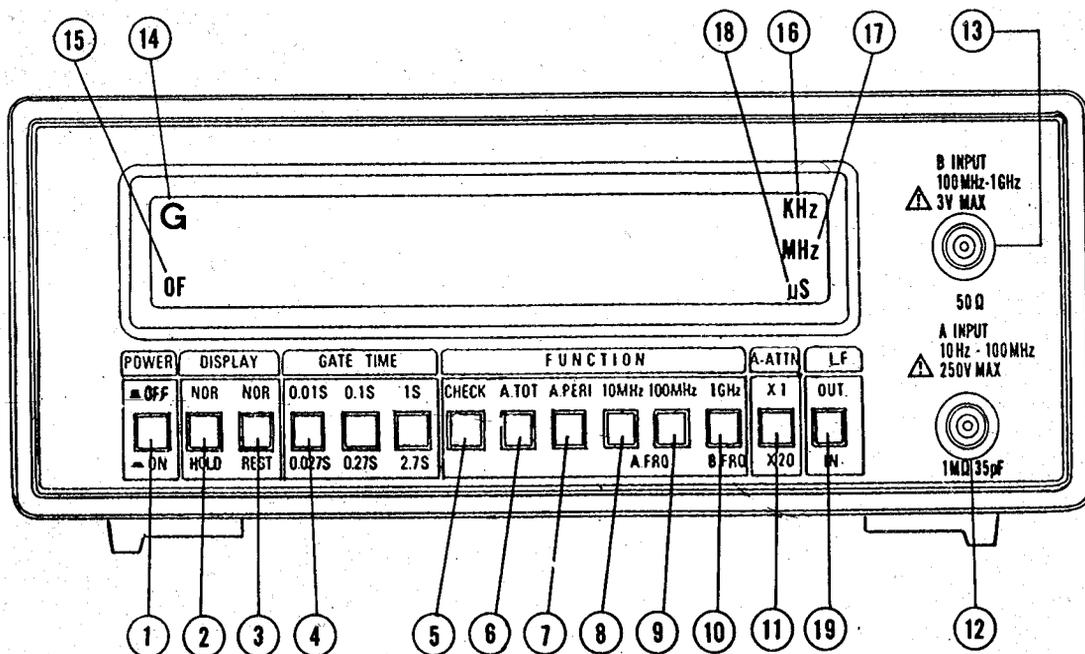


Fig. 2-1 Front panel

Fig. 2-1 shows the front panel

- 1) Power switch : To turn on, depress push-button. To turn off, again depress push-button
- 2) HOLD : In HOLD, switch IN, the measurement (except for totalize) in progress is stopped.
- 3) RESET : When pressed, immediately reset the counter to begin a new measurement. Usually used in the totalize mode to begin a new measurement.
- 4) GATE TIME : For frequency measurement, this switch is used to change gate time. When in the period measurement mode, it is used to change the multiplier factors. Each range is as follows;

CHANNEL A INPUT MODE

FREQUENCY RESOLUTION

| GATE TIME | 10 MHz range | 100MHz range |
|-----------|------------------|------------------|
| 0.01S | 100Hz resolution | 1KHz resolution |
| 0.1S | 10Hz resolution | 100Hz resolution |
| 1S | 1Hz resolution | 10Hz resolution |

PERIOD RESOLUTION

| GATE TIME | Resolution |
|-----------|-------------|
| 0.01S | 10^{-7} S |
| 0.1S | 10^{-8} S |
| 1S | 10^{-9} S |

CHANNEL B INPUT MODE

| GATE TIME | Resolution |
|-----------|------------|
| 0.027S | 10 KHz |
| 0.27S | 1 KHz |
| 2.7S | 100 Hz |

- 5) CHECK : When pressed, Counts internal 10 MHz time base oscillator.
- 6) A. TOT. : Totalizer measurement.
- 7) A. PERI. : With this switch in, placed in period mode.
- 8) A. FREQ. 10MHz : With this switch in, placed in 10MHz range frequency mode.
- 9) A. FREQ. 100MHz : With this switch in, placed in 100 MHz range frequency mode.
- 10) B. FREQ. 1GHz : With this switch in, placed in 1GHz range frequency mode.
- 11) ATT : Input signal attenuator switch. When pressed, the sensitivity is attenuated by a factor 20 for input signal.
- 12) A. INPUT : Channel A input BNC connector

- Put a signal in to measure for 10Hz-100MHz frequency, period and totalize
- 13) B. INPUT : Channel B input BNC connector
Put a signal in to measure for 100MHz-1GHz frequency
- 14) GATE indicator : Displays the opened or closed state of the GATE. When GATE is open, indicator is lit.
- 15) OVERFLOW indicator
- 16) KHz annunciator
- 17) MHz annunciator
- 18) μ S annunciator
- 19) Low pass Filter : \sim 100KHz, -3 dB
 \sim 150KHz, -3 dB at 20dB ATT

4. REAR PANEL FEATURES

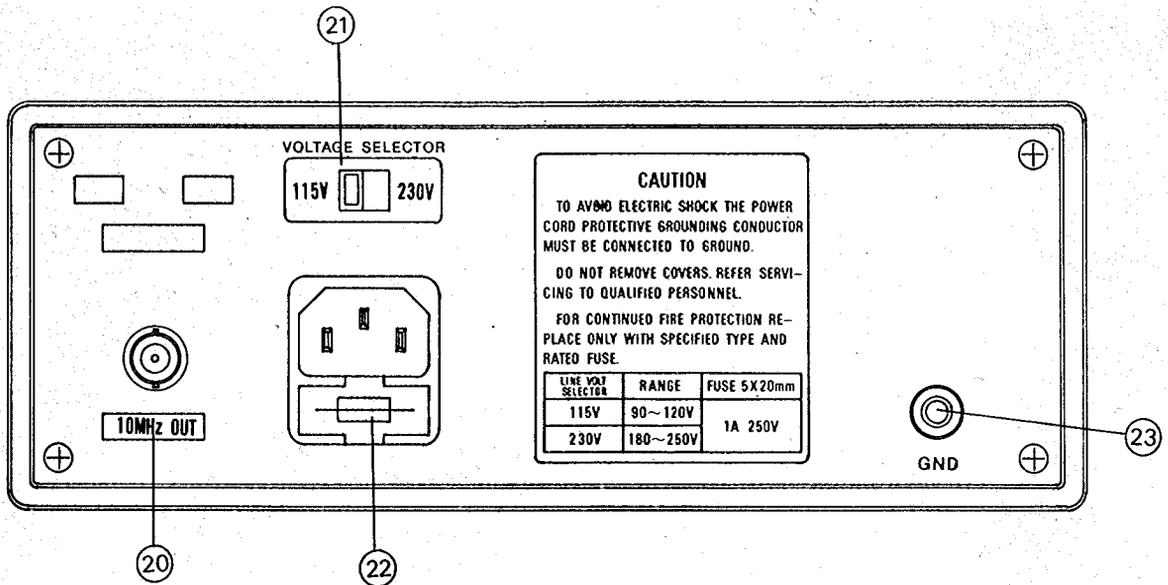


Fig. 2-2 Rear panel

Fig. 2-2 Shows the rear panel.

- 20) 10MHz OUT : Output connector for internal reference oscillator. This connector provides a 10MHz signal. It may be used as a reference signal for other frequency counters. When this output signal (10 MHz) is used, it is always terminated by 50 ohms.
- 21) VOLTAGE SELECTOR: Selects the AC line voltage. (115V or 230V)
- 22) AC INLET : Provides connection to AC power.
- 23) GND TERMINAL

5. OPERATING CHARACTERISTICS

The following paragraphs describe the operating ranges and resolution for frequency, period, totalize and check function.

5-1. Frequency Measurements.

1) Perform frequency measurement as follows;

- 1) Press the POWER switch to the ON position.
- 2) Press the FREQ. switch to select the frequency mode of operation.
- 3) Select the desired gate time.
- 4) Connect the input signal to the front-panel BNC connector.
- 5) Set ATT. to desired position. If input signal level is greater than 300mV, depressing the ATT switch will decrease the triggering sensitivity of the input section by a 20 and reduce errors.
- 6) Read the frequency on display, and observe the unit of measurement indication to the right of the display.

5-2. Period Measurements.

Perform period measurements as follows:

- 1) Press the POWER switch to the ON position.
- 2) Press the A. PERI switch to select the period mode of operation
- 3) Select the desired PERI MULTI
- 4) Connect the input signal to the front-panel A. INPUT BNC connector.
- 5) Set ATT. to desired position. If input signal level is greater than 300mV, depressing the ATT switch will decrease the triggering sensitivity of the input section by a 20 and reduce errors.
- 6) Read the period time on display, and observe the unit of measurement indication to the right of the display.

5-3. Totalize Measurements.

Perform totalize measurements as follows:

- 1) Press the POWER switch to the ON position.
- 2) Press the A. TOT switch to select the totalize mode of operation, and the RESET switch to initialize the counter.
- 3) Connect the input signal to the front-panel A. INPUT BNC connector.
- 4) Set ATT. to desired position. If input signal level is greater than 300mV, depressing the ATT switch will decrease the triggering sensitivity of the input section by a 20 and reduce errors.
- 5) Read the accumulated total on display after HOLD switch in.

5-4. Check mode.

The self-check mode provides a means of verifying proper overall operation of counter, excluding input section, time base accuracy, and time base dividers used in the period mode.

- 1) Press the POWER switch to the ON position.
- 2) Press the check switch to select the self-check mode.
- 3) Press the IS GATE TIME selector; the display should read
10000.000
with the instrument gating once every second.
- 4) Press the 0.1S GATE TIME selector; the display should read
10000.00
with a 100-millisecond gate time.
- 5) Press the 0.01S GATE TIME selector; the display should read
10000.0
with a 10-millisecond gate time.

SECTION 3 CALIBRATION

1. INTRODUCTION

Calibration is limited to adjustment of the time base oscillator frequency and the trigger level.

Time base oscillator adjustment should be made whenever the oscillator is repaired, or whenever it is determined that accuracy of the counter is not within the accuracy desired. Perform time base oscillator adjustment in an environment having an ambient temperature of +22°C to +25°C (72°F to 77°F). Allow the instrument to warm up at least 30 minutes with case on before adjusting the time base.

WARNING

MAINTENANCE DESCRIBED HEREIN IS PERFORMED WITH POWER SUPPLIED TO THE INSTRUMENT, AND PROTECTIVE COVERS REMOVED. SUCH MAINTENANCE SHOULD BE PERFORMED ONLY BY SERVICE-TRAINED PERSONNEL WHO ARE AWARE OF THE HAZARD INVOLVED (FOR EXAMPLE, FIRE AND ELECTRICAL SHOCK). WHERE MAINTENANCE CAN BE PERFORMED WITHOUT POWER APPLIED, THE POWER SHOULD BE REMOVED.

2. TEST INSTRUMENTS REQUIRED

| INSTRUMENT | Brief specification |
|------------------------|--|
| 1) Quartz oscillator | Range : 10MHz, 1GHz Temperature coefficient: $\pm 1 \times 10^{-8}$ |
| 2) Sine wave generator | Range: 1KHz — 1GHz |

3. TIME BASE FREQUENCY ADJUSTMENT

A. Time Base

- 1) Remove the counter from the case.
- 2) Select a 10 MHz output on the quartz oscillator (i.e., house standard) and connect the 10MHz signal to the counter A. INPUT
- 3) Set the front panel controls as follow:

POWER ON
NOR/HOLD NOR
GATE TIME IS
FUNCTION A. FRQ. 10MHz
ATT x1

The approximate input frequency should be in the display with an update once a second.

- 4) While observing the counter display, adjust the time base oscillator control (C25 located on the oven) to obtain a reading of 10000.000 ± 1 digit.

B. Time Base

- 1) Remove the counter from the case.
- 2) Select a 1GHz output on the quartz oscillator (i.e., house standard) and connect the 1GHz signal to the counter B. INPUT.
- 3) Set the front panel controls as follow:
POWER..... ON
NOR/HOLD..... NOR
GATE TIME..... .2.7S
FUNCTION..... B. FRQ. 1GHz
ATT..... x1

The approximate input frequency should be in the display with an update once a 2.7S.

- 4) While observing the counter display, adjust the time base oscillator control (C28 located on the oven) to obtain a reading of 1000.0000 ± 1 digit.

4. TRIGGER LEVEL ADJUSTMENT

- 1) Remove the counter from the case.
- 2) Set sine wave generator controls for 10MHz at exactly 25mV rms amplitude.
- 3) Connect generator to A. INPUT connector of the front panel.
- 4) Set the front panel controls as follow:

POWER..... ON
NOR/HOLD..... NOR
GATE TIME..... IS
FUNCTION..... A. FRQ. 10MHz
ATT..... x1

The approximate input frequency should be in the display with an update once a second.

- 5) While observing the counter display, adjust the trigger level control (R14 located on the P.C.B.) to obtain a reading of stable value.

